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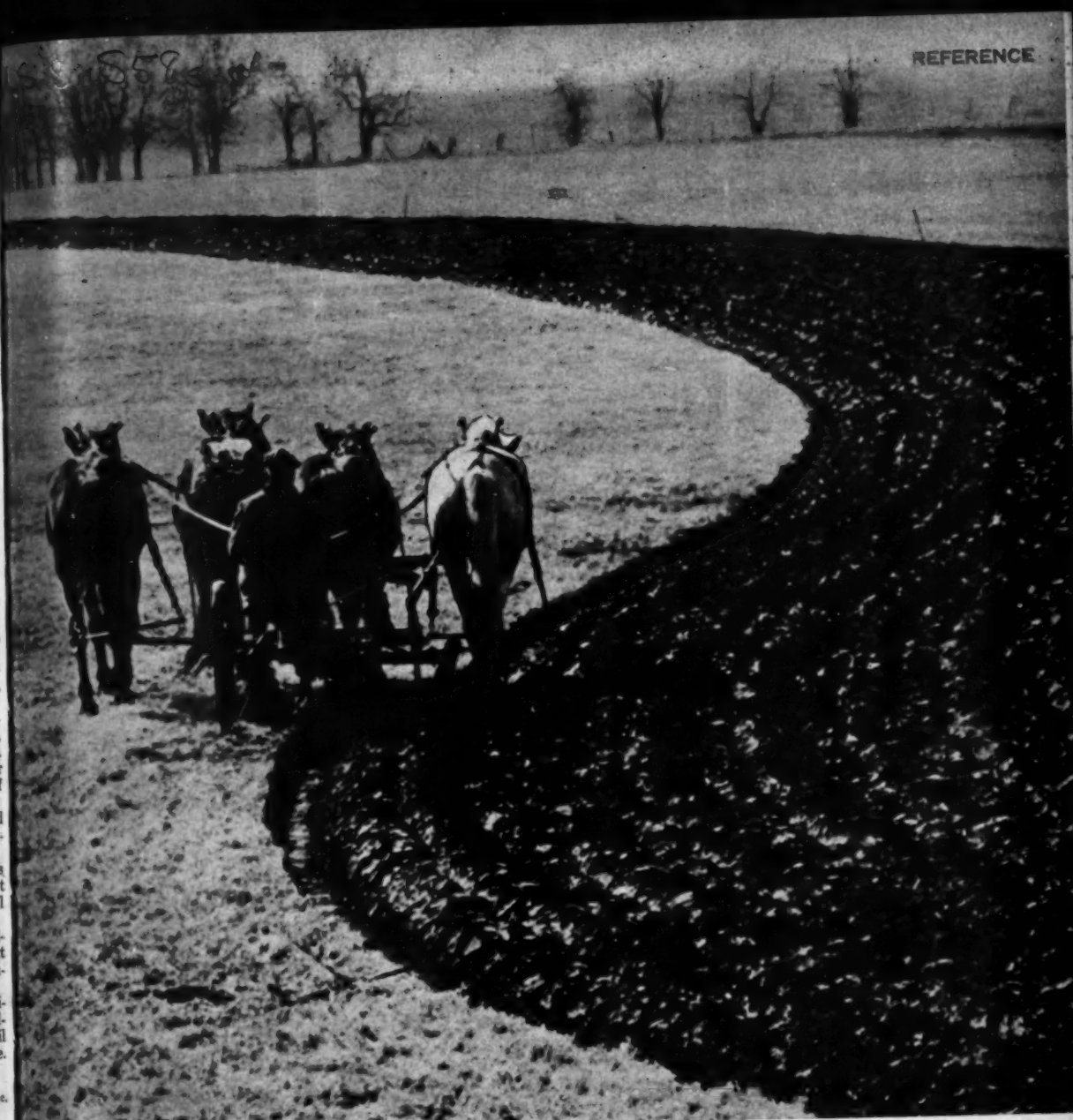
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OCTOBER 1944

SOIL CONSERVATION

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UNITED STATES DEPARTMENT OF AGRICULTURE, WASHINGTON, D. C.

SOIL CONSERVATION

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*Front Cover: Fall plowing on contour in Allen County, Kan.
Photograph by Hufnagle.*

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From poverty grass to alfalfa



By C. M. HARSH

In 1934 young Frank Hothem bought a tired hill farm. The land was typical of the thousands of acres of worn, eroded Coshocton county, Ohio, uplands surrounding it. It produced 35 bushel corn, ton-to-the-acre timothy hay, and a-cow-to-five-acres pasture. By 1943 these yields had jumped to 70 bushels of corn per acre, 2 to 3 tons of alfalfa-grass hay, and pastures which would support a husky Holstein per acre in May and June.

Then, in the winter of 1943-44, Frank Hothem sold his productive 114 acres and bought another farm—the poorest farm in the township, according to many of his neighbors.

That takes guts, ambition, a plan—and faith. Frank Hothem has all four.

Let us look at his first farm to find out how he brought up the yields and batted down the soil.

Frank Hothem bought his first farm in the midst of the depression. Although he was born

... the first farm. Intelligent planning and hard work wrought a transformation.

and raised on a hill farm of Coshocton county, Frank had worked in town for six years. His return to the land was marked by one of the worst droughts this section has ever experienced. This was not an encouraging start for a young couple married scarcely more than a year. But the Hothems were determined to make their farm pay.

In those days, when the Soil Conservation Service was still known as the Soil Erosion Service in the Department of Interior, Frank Hothem was one of the many thousands of farmers who realized that they must do something about soil erosion. He had the practical vision to know that every rain, which had been so desperately needed the year before, was now carrying away valuable topsoil and the precious lime and fertilizer earned by long hours of work and quarts of sweat.

On his own initiative, Frank Hothem began field stripping his cropland. They were not the efficient contour strips as we know them today, but they were a definite step in the right direction and they did save some soil. He did not stop here, however. He improved the quality of his

EDITOR'S NOTE.—The author wrote this article as work unit leader. Coshocton County Soil Conservation District, Coshocton, Ohio, just before leaving for service in the U. S. Navy.



... the man, and the three young Hothems.

meadows with lime and fertilizer and sweetened the mixture with alfalfa. On the pastures, Frank got busy with the mowing machine; and also put on as much lime as he could afford. Nor did he neglect the idle land, for some of the Scotch and red pine trees he planted in 1935 now stand more than 15 feet tall. In the meantime, Frank began building up a herd of Holsteins. Mrs. Hothem, who was now the mother of a son, Neal, somehow managed to raise a large flock of White Rock hens and care for an excellent garden. The Hothems also improved the dairy barn, installed a water system in the house and other buildings, built fences, and gradually put a new face on the entire farm.

It was slow, hard work, but there were results. The crop yields were going up slowly, the pastures were gradually responding to treatment, but Frank Hothem was not satisfied. Progress was too slow. His new plan for rebuilding this farm was good, as far as it went. He realized something was missing. Frank Hothem set out to find the answer.

His first stops were at some of his neighbors' farms. For, in the meantime, they, too, had become concerned about their soil losses, their drop in yields and their lowered income. Like Frank, a few of them such as Simon and Paul Scheetz, Alton and Ralph Lautenschlager, and Paul Foster were doing something about it. They were co-operating with what was popularly known as the Coshocton Research Project—a hydrological experimental station and watershed which is pioneer-

ing research of the raindrop and all of its influences. It was at these farms Frank Hothem found his answer.

He saw the excellent results of such practices as strip cropping on the contour, diversion terraces, wholesale pasture improvement, and all the other soil-saving, yield-building practices as they were installed on the advice of the technicians of the Soil Conservation Service. It was as though the tired land had received a life-giving transfusion.

Perhaps Frank Hothem went home and tried to visualize such a plan as applied to his own farm. When he was convinced that this new system of round farming for round country was sound, he made his decision, drew up his program.

Briefly, this is the plan he applied to his farm, made with the assistance of H. W. Black, soil conservationist, Coshocton Research Station.

On the cropland, the strips were changed from straight lines to curved ones that followed the contour. A diversion terrace was installed to break up a long watershed. With the assistance of CCC labor, the straight fences were ripped out and contour fences constructed. A four-year rotation of corn, small grain, and two years of alfalfa-grass meadow was adopted, with the amounts of lime and fertilizer applied during the rotations doubled.

On the permanent pasture lands, Frank's program of applying lime and fertilizer was not changed, merely intensified.

More than 6,000 additional trees were planted and protected. The established woodland was fenced off from livestock.

Several tons of additional limestone helped Frank get his soil conservation program into operation rapidly.

None of these changes could be considered radical, for he had already operated his farm on a sound basis. But these changes, simple as they were, combined with his general all-around, good farming practices, brought results. His yields, and the value of his land, spurted.

Frank Hothem was thoroughly sold on his farm plan. In an interview with local reporters in 1942, he said, "I started this conservation program in the spring of 1938, and I would say that it required less work than the old style farming. It takes less horsepower and the machinery problem has not changed. By using the same machinery and putting in the same amount of labor there is no question but that there would be an increase in the amount of crop production. Taking into consideration all crops, I would say that I

have increased my production at least 25 per cent."

Continuing the interview, the reporter asked, "Is your farm going to be worth any more to the country now in this Food for Freedom program because of your conservation farm plan?"

Frank replied, "The trouble in the last war was that erosion took such a heavy toll on so much land because everyone tried to get high production, and they farmed the land in a way that was wasteful of the soil. The change in our practices will do much to control this erosion and we are going to be able to get increased production without wasting soil and destroying the land. Then, when the war is over our farms will have produced more and they will be in fine shape. If another slump comes, we will be in a better position to go through it with our good land than farmers were, following the last war, after their soil was badly depleted. In my mind, there is no doubt that we are meeting increased production and still protecting our lands."

Last winter Frank sold his farm. Ten years of hard work went with the land, which was purchased by a relative, Edwin Hothem, a good conservation farmer himself. The farm will continue to improve under the skillful hands of its new owner.

Why Frank Hothem sold his farm does not matter. Perhaps he took away a small profit in addition to the equity he had built up, but his real profit was a lot of know-how.

Frank wasn't through farming. He considered buying a high-producing, expensive river bottom farm. Finally, when the blue chips were down, he chose another hill farm.

No doubt there was plenty of eyebrow-lifting and head-shaking over the farm he selected. It had been virtually abandoned for 10 years. Briars

and sumac sprouts over-ran the pastures, the crop fields were choked with hip-high weeds, the fences sagged, and the buildings needed repairs.

Frank Hothem looked beyond the weeds, the briars, and the sagging fences. The farm laid well. Predominantly gently rolling slopes, only a small portion of the land was too steep for cropland, and that was protected by a thrifty stand of young timber. The buildings were located conveniently; the farm was split by a good road. Before he made up his mind Frank went a step further, a step many prospective buyers had failed to take. He dug down. He found from four to six inches of topsoil remaining. That was what he bought—160 acres of it.

His first step following the purchase of the farm was to consult County Agent G. H. Chambers. His next move was to call at the offices of the Coshoc-ton county Soil Conservation District. Although the district was scarcely more than a year and a half old, more than 160 farmers were already co-operating, which is indicative of the progressive attitude of Frank Hothem's neighbors.

In requesting technical assistance from the district, he said, "I want a soil conservation program on my new farm based on the same identical principles as my other plan."

W. S. Donaldson, district technician, collected the aerial photographs of the farm and called on Frank. This is the farm plan they worked out together:

Fifty-four acres were selected for cropland. A 4-year, 2-unit system was planned. Of course, all of the cropland was laid out in contour strips. In one unit, the alternate strips were planned for corn the first year. In the other unit, a small grain crop was planted and seeded in new mea-

... the second farm. A rebuilding program lies ahead.



dow. Some of the idle strips were put to use by seeding them with an emergency hay crop. Others were established in trash-mulch (site preparation by disking rather than plowing) seeding of alfalfa-grass meadows. The fertility program calls for a minimum of 3 tons of agricultural ground limestone and 600 pounds of complete fertilizer per acre for each complete rotation.

Seventy-four acres were set aside for permanent and supplemental legume pasture. A treatment program, which embodies generous and repeated applications of lime and fertilizer, and frequent use of the mowing machine, was agreed on. The ratio of summer legume pasture to permanent bluegrass was approximately one to two.

Livestock was excluded from 30 acres of young woodlands, a portion of which was improved with the addition of 1,000 seedlings.

The remainder of the farm was set aside for buildings, a garden plot, and feeding lots.

Although it was early March, this year, before the Frank Hothems moved onto their new farm,

they have made excellent progress in 5 short months. They have concreted the barn and installed stanchions to make it available to the dairy herd. They have built a new chicken house. A water system has been added to the house and barn. The trash-mulch seedings of alfalfa look grand. The corn and oats hold prospects of a good harvest. The mowing machine has been busy in the pasture fields, and applications of lime and fertilizer have already been made. New fences are going up.

Frank and his dark-haired, pretty wife now the mother of three, are pretty sure to succeed in their new undertaking, for they know what it takes to bring the land back.

Frank Hothem has proved that the gap between poverty grass and alfalfa is not so wide as some think. It is generally considered a lifetime task to rebuild one farm, almost impossible to rebuild two farms profitably. Frank is exploding that theory.

We need more Frank Hothems.

STUBBLE MULCHING WITH ASPARAGUS TOPS



By OTTO F. SCHNELHARDT

Using their asparagus tops for soil protection and improvement is credited by growers in the East Benton Soil Conservation District near Kennewick in south-central Washington with increases of as high as a ton per acre in yields of this vegetable crop.

EDITOR'S NOTE.—The author is work unit leader, Soil Conservation Service, Kennewick, Wash.

Dan F. Beegle's asparagus shredder. Dormant tops are cut and spread on the field. Observe the horizontal and vertical cutting bars, and the elevator arrangement for conveying plant material into the silage cutter. Neil Anderson, on tractor, and Virgil Masters, on shredder, perform on Gerber Brothers ranch.

A simple rig for handling dormant asparagus top growth efficiently as a "stubble mulch" and getting away from the conventional practice of disking it twice during the December-February

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dormant season has been invented by Dan F. Beegle, one district grower. It is an asparagus shredder, and a machine that has proved successful in breaking up the heavy top growth that results when the asparagus is irrigated and fertilized after harvest to store reserve plant food in the roots. Beegle built two of these machines and sold one to Neil Anderson in the district.

The device consists of a vertical and a horizontal cutting bar, an elevator and a silage cutter. The machine is driven by the power take-off on the tractor. The height of the cutter bar can be regulated from the tractor. A second man rides the shredder, however, and forks the tops in to prevent plugging. Beegle cuts 4 or 5 acres a day with this outfit.

With it, the tops are chopped thoroughly into short lengths and spread behind the machine. The field then is disked to mix the residues with the soil and aid decomposition. One advantage claimed for this method is that the shorter lengths break down more readily and do not interfere with cutting the shoots at harvest time, which usually starts in this area between April 1 and 15 and ends between the first and fifteenth of June. Shredding the tops has been found to reduce soil blowing more effectively than disking alone, because of the uniformity with which the residues are mixed with the soil. The resultant mulch also lessens injury to growing shoots from sand blasting.

Beegle reports increase yields of 400 pounds to the acre from the use of the shredder on his ranch. His 7-acres of asparagus has not reached full production, and he believes the yields will be further benefitted as the plants attain full bearing age.

Representative of the benefits resulting from returning asparagus top growth to the soil is the experience of William and Frank Gerber in the East Benton district. A 40-acre field of theirs on which the two tons per acre of tops was returned to the soil produced 176 tons of marketable as-

(Continued on page 72)



The shredder at work. Heavy top growth at right, evenly spread residue mulch at left and bottom.



Close-up of earth-cutting lug on one of the planters. The machine works equally well on wet ground or dry.

By MARION M. WEAVER
and RAYMOND N. FISHEL

Wartime labor shortages, and the tree-planting problems of two farmers in Cattaraugus county, N. Y., furnished the incentive which resulted this past year in two home-made but efficient planting machines being devised by the authors of this article. The machines differed greatly from each other, except for the fact that each was made at trifling cost out of materials found on the two farms.

When Mayne Howard, whose farm is near Franklinville, N. Y., faced the prospect of hand-planting 30,000 trees by using the conventional mattock, he decided he needed some sort of mechanical contraption that would save time and labor. Because Howard is a cooperator in the Cattaraugus Soil Conservation District, the district directors put his problem up to us. With Howard's help, we contrived the first of the two machines.

This home-made tree planter had as its chassis the front wheels, the axle and the tongue of a wide-tire dump wagon. To each of these front wheels were attached two lugs, cut from a worn road-scraper blade. Each of the four lugs, 18½ inches long and 5 inches wide, was bent L-shaped, with one side 8 inches long and the other side 10½ inches. The 10½ inch side was curved from a point 6 inches from the L to the sharpened end. This made it possible for the lug to pierce the ground more readily and prevented the wheels from sliding.

The clamps which held the lugs to the wheels were each made of 2 pieces of ¾ inch metal, 3 inches wide and 8 inches long, cut from an old

EDITOR'S NOTE.—The authors are, respectively, work unit leader and farm planner, Soil Conservation Service, Franklinville, N. Y.

wagon tire. Holes were burned through the end of the clamps with a welding torch, and two clamps were fastened by half-inch bolts to each lug. The cost of all materials was \$1.18.

The machine was weighted as needed by placing large stones on the central framework between the wheels. Because the lugs get out of line when turning at the end of the row, they have to be



Three men can plant 1,000 trees an hour with this modified walking plow. Attachments on moldboard cause furrow slice to drop back in furrow after tree is in place.

synchronized after each turn by revolving one wheel by hand so that the parallel rows of holes will be properly spaced in relation to each other.

The planter makes a cut in the ground 8 inches deep and 5 inches across, and it works just as well in wet weather as in dry. When the ground is wet the hole is more like a slit, and the tree is planted by placing it in the slit and tramping each side of it with the foot. In dry ground the curve on the lug makes the soil come out in a clump, which is deposited beside the hole. The tree is then placed in the hole and the clump of earth is packed around it.

With this machine, Mr. Howard has been able to plant 2,000 trees a day, compared with the 1,000 a day which was his average when using a mattock. To prevent excessive drying of the soil, just enough holes for one day's planting are dug in the morning and then the trees are placed and the soil packed around them.

Inspired by our success with Howard's planter, we decided to go a step further and design a planter that would not only dig the hole, but also virtually plant the tree in the same operation. Never having seen a tree planting machine except the one designed for Mr. Howard, we started from scratch.

We borrowed a walking plow from Howard Morris, a farmer who had trees to plant and was short of labor. We removed the moldboard and

installed a new one to which "alterations" had been made. The alterations consisted of four pieces of steel wagon tire, 3 inches wide, laid on the plow with the curve down. The joints had been "spotted" with a welding torch just enough to hold it together for moving. Then the new piece was laid on the welding block and the seams joined with a continuous weld. Holes were bored to match the ones in the frame which held the original moldboard.

The altered moldboard allows the furrow slice to fall back in the furrow instead of turning it over. At the time the furrow slice is passing over the moldboard, a tree is placed in the furrow. Then the furrow slice falls back on the root. Drawn by a rubber-tired tractor, the planter requires three men to operate it: one to drive the tractor, one to place the trees and a third to hold the plow and tamp the tree with his foot. Three men would seem to be an extravagant use of manpower, until it is considered that they can plant 1,000 trees an hour by this method.

We haven't finished with tree planters. Next year, we plan to develop a still better machine—one that will tamp the trees automatically and also provide a seat for the tree-placer.

STUBBLE MULCHING

(Continued from page 71)

paragus in 1943, or from one-half to a full ton to the acre more than the average for the district. This was more than four tons per acre, from a 6-year-old stand.

In 1944, this same field yielded 185 tons, despite unfavorable weather conditions.

All growers in the district put on heavy applications of barnyard manure and commercial fertilizers, in addition to using the top residue. One grower mows his tops, runs them through a hay chopper, uses them for cattle bedding and returns them to the asparagus field with the manure.

Asparagus is one of the main cash crops in the East Benton district. The 1943 crop census of the irrigation districts in this soil conservation district showed a production of 6,449,277 pounds from 1,806 acres, with a total value of \$483,701, or \$267.83 an acre.

Growing concern for soil conservation and land use problems is evidenced by the recent formation, in the Ecological Society of America, of a subcommittee on soil conservation. The subcommittee forms a group within the society's committee on applied ecology, with Edward H. Graham and C. W. Thornthwaite included in the membership.

WATER SPREADING



By WAYNE H. MILES

The term "water spreading," a comparatively new word in the vocabulary of ranchers and conservationists in the West, is used to designate a wide variety of gully control and flood irrigation structures. Water spreading has found wide favor among ranchmen because it fills a long felt need for a practical method of gully control on range lands.

Water spreading may be defined briefly as the practice of diverting water from an intermittent stream channel or eroded land to an area where it is loosed upon native grassland to flood-irrigate the sod. When properly designed and carefully installed, spreaders control gully erosion and at the same time increase production of palatable grass.

Reduced to its simplest form, a spreader may consist of a single furrow or small ditch leading from a channel to an area not wetted in low flows. Some of the larger spreaders, on the other hand, are made up of rather complex combinations of large dams and dikes designed to flood a section or more of land.

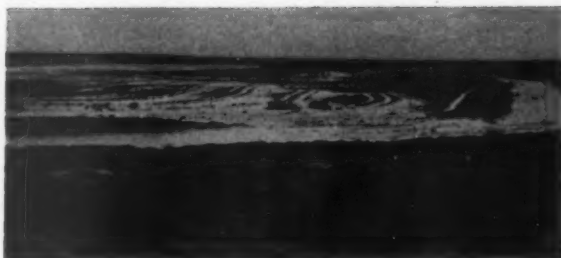
EDITOR'S NOTE.—The author is district conservationist, Soil Conservation Service, Tucumcari, N. M.

Dam and dike type water spreading diversion on Myrl Jowell ranch, 10 miles southwest of Quay, N. M. Dam in foreground plugs small gully; dike and ditch carry flow to spreading area in right background. Dike does not connect with dam, a small opening being left to permit part of flood flow to by-pass to another dike below.

Water spreading has proved popular with ranchers. For about two months in the spring of 1943 almost the only green grass on the Chapman brothers' 30,000-acre ranch south of Endee, N. M., was some 500 acres in a large water-spreading system. This spreader was flooded by a rain late in the fall of 1942, but there was not enough rainfall in 1943 to permit a spread of water, yet, the carry-over of soil moisture resulted in an excellent growth of grass.

Gullies cutting back from the side of Charco Draw on the J. A. Kinkead ranch south of Montoya, N. M., threatened to ruin an especially productive grass flat. A spreader dike, built parallel to the draw in 1940, has put a stop to gullying, and the diverted water spreads over an old flood plain to grow more grass. Another spreader on this ranch protects a spring.

Shoestring gullies leading out from the base of Circle S mesa on the Myrl Jowell ranch near Quay, N. M., caused livestock to travel long distances to reach grass and barred the path to range riders.



Water spreading below a diversion dike on Horace Horne ranch, 2 miles south of Bard, N. M. This diversion picks up water above gully headcut. Note how part of the water spreads through the opening in foreground, and part passes on down ditch to spread through openings in background.

Spreader dams built in 1942 control erosion and provide crossings.

The road to Herman DeOlivera's ranch was so badly gullied in the fall of 1941 that it was almost impassable. Spreader dams in the gullies and road bars in the road have controlled most of the erosion. One of the spreader dams serves as a road crossing.

These examples show some of the possibilities of the practice and illustrate why it is in such good favor with ranchers.

Many factors must be considered in order to arrive at a safe and economical design for spreader work. Technical guidance is commonly sought from Soil Conservation Service technicians.

During the last four years the Canadian River Soil Conservation District of Tucumcari, N. M., has cooperated with several ranchers in laying out and constructing large and small water spreading systems on 7,100 acres of range land, as a part of well-rounded conservation plans worked out with individual operators.

The relationship between acreage in a spreader system to acreage in drainage is of prime importance. Care is needed to avoid over-developing a large spreader area which does not have sufficient drainage above to provide adequate flows for spreading; or, on the other extreme, has too small a spreading area compared with the drainage, with the result that too much water running back into the drainage below the spreader causes erosion. A ratio of 10 acres of drainage to one acre of spreader area is considered about right for the Canadian River District, with ratios of 5 to 1 and 25 to 1 being the extreme limitations.

It must be kept in mind that most flows will be low, and that extensive spread must be obtained from them. There often is a tendency to design spreaders so that satisfactory spread is obtained only under maximum flow.

Applying the experience of local ranchers and their own observations and study, Soil Conservation Service technicians have assisted the district board of supervisors in developing general guides and specifications. These recommendations are based on local conditions, but may provide some usable ideas to persons interested in this type of conservation work in other localities.

Care must be taken to see that overflow from the spreader returns to the channel with the minimum of cutting. At times, a stable, natural channel is available. In other instances, it may be necessary to return the water to the channel by vegetated or mechanical structures.

Sand spreading from seriously eroding channels is a problem frequently encountered. Some light sanding or silting may be permissible, particularly if only relatively small areas are damaged. Construction of the diversion dam at a point where it will provide a silt storage reservoir is often indicated for the prevention or delay of sanding in the spreader area. Where the problem appears to be serious, the first dam may be built at the lower of two or more alternate sites with the expectation of later building at another site when the first dam becomes filled with sand and silt. Fencing the silt basin and part of the channel above diversion structures allows grass, weeds, willows, and other vegetation to start. This serves to screen out silt. The desilting effect of spreaders is excellent and may be used to advantage to protect retention structures such as stock water dams and irrigation reservoirs.

An eye for picking points of diversion which will achieve the maximum of spreading with a minimum of structural work is highly essential.

Some points meriting consideration: 1. locate, if available, a site above a gully headcut, thus avoiding the construction of an expensive dam; 2. place the diversion works as nearly as possible at the upper end of a favorable spreading area; 3. build the structure at a narrow and shallow point in the drainage in order to reduce the size of the dam; 4. look for places where the banks of the channel below the point of diversion are higher than the surrounding grassland and will prevent water from returning to the gully; 5. look for old grassed channels into which water can be diverted, thus avoiding the need for a dike or ditch; 6. try to choose a spot where no channel has been formed, and where part of the water from extreme flows can be by-passed safely; 7. select sites with safe and adequate spillways; 8. put diversion dams just below a bend in a gully channel, where possible, to allow flood waters to jump the gully bank with-

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Water spreading on Chapman Brothers ranch, 8 miles south of Endee, N. M. This spreader dam plugs a small gully not visible here, and water spreads around both ends of the dam.



Grass growth resulting from water spreading. This is a repeat of the picture above. Grass is a mixture of galleta and blue grass.

out changing direction of flow, as this often reduces strain on structures; 9. choose sites where a cut spillway will reduce the size of dam required (one dam on the Canadian River District was reduced from 6,000 to 3,500 yards by this means.)

Combination-type structures which serve also as stock dams, road or stock trail crossings, or serve to protect springs are particularly favored.

Large gully control dams should be constructed with minimum front slopes of 3 to 1 and back slopes of 2 to 1. A 7-foot crown width should be the minimum, and on higher dams this crown width should be equal to one-third the maximum height of the dam plus 5 (on a dam 12 feet high at the center $\frac{12}{3}$ plus 5=9-foot minimum crown).

An adequate spillway cross section to pass high flood flows is very necessary. The cross section required should be determined by the size and type of watershed, and should be based on the maximum storm to be expected once in 25 to 50 years. Two feet of extra dam height or free board may be added to the required spillway as a safety factor.

It has been the practice in the Canadian River district to design dikes to carry a flood flow to be

expected once in 25 to 50 years without additional freeboard. Some overtopping is anticipated, but repair costs are not excessive and occasional maintenance is often less expensive than building the dike to take care of extreme flows.

The size of diversion dikes and ditches is governed by the head to be handled and the area to be watered.

Dikes should be designed at the proper grade or fall so that they will carry the maximum flow without causing erosion in the channel. The grades shown in Table 1 for various height dikes are considered adequate for average conditions in the Canadian River district. These grades also will be approximately correct for ditches having the same depth. Flow velocities of 2 to 2½ feet per second are recommended where there is a ditch above the dike or where soils are none too stable.

TABLE 1.—Grades for diversion dikes.
[Computed from Manning's Formula using $n=.04$]

Height of dike, or depth of ditch	Recommended grade in feet per 100 feet	
	V=2.0 ft.	V=2.5 ft. per sec.
Feet:	Feet:	Feet:
1.0	0.73	1.14
1.5	.43	0.66
2.0	.29	.45
2.5	.22	.34
3.0	.17	.26
3.5	.14	.22
4.0	.12	.18
4.5	.10	.15
5.0	.09	.13

On heavy sod and in stable soil the velocity of flow above a dike may be increased perhaps to 3 or 3½ feet per second provided the borrow ditch is on the lower side only and the sod is not disturbed above the dike. (Doubling the grades in Table 1 for V=2.0 feet per second gives a velocity of 3 feet per second.) This method results in reducing the size of dike required and has cut construction costs on several dikes in the Canadian River District.



Severe gully erosion on J. A. Kinkead ranch, 15 miles southeast of Montoya, N. M. Erosion in this headcut has been stopped by diversion dike showing as dark line above headcut. Diverted water spreads over grass to increase production.

TABLE 2.—Carrying capacity of dikes in cubic feet per second.
[V=2.0 ft. per sec.]

Heights of dikes on recommended grades	Cross Slopes								
	0.5 percent			1 percent			2 percent		
	Low grass 0.2 ft.	Med. grass 0.5 ft.	High grass 0.8 ft.	Low grass	Med. grass	High grass	Low grass	Med. grass	High grass
1.0	150	50	20	75	25	10	35	15	5
1.5	360	200	90	180	100	45	90	50	20
2.0	700	440	250	350	220	125	175	110	60
2.5	1160	820	550	580	410	275	290	205	135
3.0	1710	1320	940	855	660	470	430	330	235
3.5	2370	1940	1470	1185	970	735	590	485	365
4.0	3200	2620	2080	1600	1310	1040	800	655	520
4.5	4050	3480	2800	2025	1740	1400	1025	870	700
5.0	5000	4440	3650	2500	2220	1825	1250	1110	910

Table 2 gives the capacity of various sizes of dikes. The dike capacity is affected by cross slope or ground slope, height of grass, and fall or grade. Grass height has been divided into three classes, low, medium and high, for each cross slope and height of dike. This table is based on design grades as shown in Table 1 for velocities of 2.0 feet per second.

By extrapolation, Table 2 may be used for greater cross slope (ground slope). For example the capacity of a given dike on 3 per cent cross slope is 1/3 the figure shown for a 1 per cent slope and the capacity of a dike on 4 per cent slope is 1/4 the figure shown for a 1 per cent slope.

As velocities of flow are increased the capacity of the dike increases. Therefore, the capacity of a dike designed for a flow of 2.5 feet per second is 25 per cent more than the figure shown in Table 2. The capacity of a dike designed for 5.0 feet per second is 50 per cent more than the figure shown in Table 2.

The necessity for a type of supplemental structures will depend on topography, slope, soil, and vegetation as well as the equipment and materials available. Construction of many of these structures can be delayed until after the spreader has functioned in order to see just what is needed.

Flat slopes with a fall of less than 3 feet in 100 feet and a heavy sod of such grasses as galleta and tobosa cause maximum spreading with a minimum of supplemental structures. Such conditions are usually found in flood plains.

Graded dikes, ditches, and furrows of the type shown in Figure 1 may be used to get a better spread where natural spreading below the diversion structure is not adequate, or where concentration of water might lead to further erosion if not checked.

Percolator structures of loose rock, brush, or wire have been widely used in other areas as sup-

plemental structures but have not been used to any great extent in the Canadian River district because of the rather high labor outlay necessary for this type of construction.

Active gullying at the point of diversion often prevents the very desirable practice of diverting only part of the flow and allowing the rest to continue down the same channel. On supplemental structures, however, it often is possible to pick up only part of the flow. In this case, the diversion may be designed to carry only enough water to flood a given area instead of the entire flood flow of the channel. The head necessary for a given area will vary but one second foot per acre; or one second foot for each two acres to be watered is a good average.

A wide variety of structures may be used, and a wise choice is called for, as the value of increased grass growth should in most cases govern the cost of construction. The protection of valuable property threatened by the gully or by deposition from the gully will often, however, justify more expensive structures.

Before construction starts, the site should be properly prepared in order to insure that the fill will bond properly with soil. Vertical or very steep banks should be cut down to a slope of 2 to 1 or preferably 3 to 1. This slope should be cut to the very bottom of the original bank. Brush, weeds, and grass should be cleared off, and the site of the dam or dike should be plowed or ripped before the fill is started. A keyway should be dug to good material if the gully bottom is sandy. Where dams are high or soils are unstable, fills should be put in moist and given some compaction. The completed structure should have 10 per cent added height to allow for shrinkage.

Spreaders constructed to date have generally doubled the yields of grass. This would indicate
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FARM FORESTRY TO THE RESCUE



George E. Tindall bringing a redwood log to his sawmill.

By FRANK B. HARPER and IRVING F. PEARCE

Distributors in the Watsonville, Cal., vegetable and fruit growing area can testify to the war-time importance of containers and other woodland products that George E. Tindall and others are supplying from their local farm timber.

To Tindall, an old hand at making the best use of farm timber, there is the three-way satisfaction of turning out badly needed war materials, making a good profit, and harvesting his tree crop to assure a sustained yield in days of peace to come. This is in the coastal redwood belt.

By 1943, a critical shortage of fruit and vegetable boxes and crates developed as a result of curtailed commercial timber manufacture and the

draining off of labor for military service and war plant work. The Pajaro Valley alone uses approximately 2,000,000 new apple boxes a year and about the same number of lugs, carrot or lettuce crates, artichoke boxes and the like. In casting around for new sources of supplies, distributors contacted District Conservationist Clyde M. Seibert and other Soil Conservation Service men working with farmers of the Pajaro Soil Conservation District and the old Corralitos Creek erosion control demonstration project. They, in turn, passed the work along to Tindall and others, following up with technical assistance and information on markets, sawing methods, and equipment.

The war job fits in nicely with Tindall's farm forestry operations. Ever since 1898, when he hewed a farm out of the woods in Eureka Canyon 13 miles northwest of Watsonville, above Corral-

Editor's Note.—The author's are, respectively, head of the current information section, Soil Conservation Service, Portland, Oreg., and work unit conservationist on the Pajaro Soil Conservation District, Watsonville, Cal., Soil Conservation Service.

itos, he has harvested woodland products. He cuts on a selective or sustained-yield basis, harvesting only mature trees or those which are defective or diseased, leaving the thrifty, rapidly growing young and middle-aged trees for future harvest, instead of clear cutting and laying his land bare to erosion, fire and useless brush growth.

In 1942 Tindall harvested \$1,752.45 worth of products from the 200 acres of woodland that makes up the biggest part of his 260-acre place. He realized from lumber, \$600; tan bark, \$615; fuel from oak, madrone and redwood, \$250; Christmas trees, 199.15, and huckleberry and fern sprays, \$88.30. He also has sold fence posts, pickets, grape stakes, piling, bridge stringers and decking, sawed shakes, and rustic for log cabins and pergolas.

It was in 1938 that Tindall installed a small American mill, cutting 75,000 to 80,000 feet of lumber a year from his second-growth redwood. When the fruit and vegetable container shortage developed, he and his son Weldon decided to add their own shook manufacturing equipment and turn out container material, both for the Tindall farm itself and for other farmers.

This is how the 1943 production record for the Tindall farm added up: 80 thousand board feet of car stock (bracing and bulkheads), \$3,600; 12 thousand board feet of shakes, \$450; 20 cords of tan bark, \$500; 15 cords of fuel (oak and madrone), \$300; 70 cords of fuel from redwood slabs as a by-product from the shook manufacture, \$840; 250 Christmas trees, \$250; and \$70 worth of huckleberry and fern sprays. The total return from these products was \$6,010. The 1944 output is expected to run about the same.

The Tindalls—including even Mrs. Tindall, who takes her turn at stacking shook and doing other labor relief jobs around her husband's mill—did not attempt to make the completely nailed product. Instead, they made and sold box shook for Los Angeles lugs, in which are marketed tomatoes, early potatoes, squash, apricots, plums, peaches, cherries, grapes, sweet potatoes, egg plant, peppers, cucumbers and other products. They also made car strips, grape lugs and vegetable crates. The crates are used for peas, carrots, spinach, onions, beets, turnips, radishes, lettuce, broccoli, cauliflower, celery, cabbage and snap beans.

Others in this area who are manufacturing essential items from their farm woodlands include O. R. Watts, 2 thousand board feet of shook a day; Lawrence Cusack, 3 thousand board feet of tree props and lumber a day; Peter Tuana, 100 redwood posts a day; and F. M. Pohl, 2 thousand

board feet of shook a day. It is all "extra" income.

Local dealers looked for the 1944 shook situation to be about the same as it was in 1943. Their appreciation of these locally developed sources of supply is reflected in the comment of A. L. Waugarman, a large-scale Watsonville shook dealer:

"The material from second growth redwood is satisfactory for shook. I'll take all that is supplied to me. The output from any one mill is not so great; it is the combined output of many small mills that counts."

Tindall estimated that he had a million and a quarter feet of marketable redwood when he started his mill six years ago, and Soil Conservation Service foresters place at approximately 10

(Continued on page 88)

Tindall makes shook for vegetable and fruit containers with special machinery he bought in 1943 for the wartime job. Looking on approvingly is John F. Preston, chief of the forestry division of the Soil Conservation Service.



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Jim Fort Rast was front runner in a state-wide essay contest sponsored last spring by the South Carolina Bankers Association in cooperation with soil conservation district supervisors. He won a \$75 war bond, and the satisfaction of producing a manuscript that would have done credit to many of his elders. Two second-place awards went to top contestants from the Piedmont and Coastal sections of the state, and there was a further break-down of prizes on a county basis. The competition was financed by contributions from individual banks. The project resulted from "the interest of bankers in problems of the farmer and in the development of a better program of agriculture in South Carolina. It is hoped that this activity will aid in stimulating interest among youths and adults in the importance of conserving our natural resources."

There is no sadder sight...

By JIM FORT RAST

Near my home at the foot of South Carolina's sandhills, there are several ruined farms. All of them follow the same general pattern as the Old Martin place, whose case I shall present. The main "attraction" is the ruined house, with its gaping windows. The one disillusioned Negro tenant on its six hundred ill-kept acres lives, with his family, in a less leaky hovel which was once a barn. All about is the flavor of ruin—broken plows, empty cans, rusted pots, and rotted wood—all telling the sad story of neglect. The fields are full of gullies and broomsedge.

There is no sadder sight. When the grandfather of the present owner moved here, the fields had just been cleared. He grew fabulous crops and built a fine house which was far renowned for the graciousness and hospitality of its occupants.

Grandfather Martin reared 11 children on that farm. They all grew up to be prosperous. So what did it matter if the heavy rains were allowed to take their natural course, breaking furrows and washing away valuable top-soil? What did it matter if, every few years, new ground had to be cleared to replace eroded fields? The woods and fallow fields were burned each year, and those fields, unprotected by vegetation, were soon gul-
lied and useless for cultivation.

In short, by the time grandfather was old, he was forced by failing crops to move to town in order to live in the manner in which he was accustomed to living. In town he died, leaving his son James in possession of the farm. James, in order to live well, cut all the timber ruthlessly and further mined the land.

James reared his family on the farm and died there. But his children did not want to live on the farm. And so tenants took over, their quality receding from well-to-do white to poor white, from average Negro to poor Negro. Soon the poor Ne-



The winner—Jim Fort Rast, 16, Swansea, S. C., receives war bonds as first prize in statewide essay contest on soil conservation. Left, E. C. McArthur, Gaffney, S. C., president of South Carolina Association of Soil Conservation District Supervisors; right, E. R. Alexander, secretary of South Carolina Bankers' Association.

gro will move away, disappointed and underfed, leaving the farm as the perfect example of ignorant waste.

This farm had sent 19 children out into the world to become prosperous. While it was still rich it had supported some 80 people, counting tenants. It had paid large amounts of taxes to the local, state and national governments. The trade which it helped to bring enriched the nearby town. It was the foundation of the nation. In time of trouble, it was always ready to contribute. It can, alas, no longer carry on its fine work. *It is gone.*

It is easy to look back and think of what might have been done. It is easy to say that this waste could have been prevented as easily as not. But now it is too late.

Had a modern progressive farmer been in charge he would have terraced the fields to hold the rain and prevent erosion. He would have constructed barriers to hold back the soil.

Perennial crops such as kudzu, sericea lespedeza, and alfalfa would have kept the steep land in use, prevented erosion, and provided enriching humus.

The forests would have been cut wisely, and reseeded after cutting, so that there would always have been a source of money in lean times. Shelter belts of trees would have been planted to prevent wind erosion.

A modern progressive farmer would not have burned off the fields and woods each year. This wasteful practice of burning off sent valuable, soil-enriching vegetation up in smoke, and also destroyed most of the cover for game on the farm.

Contour plowing would have been used to prevent the water from running off. Strip cropping, (alternating strips of sod crops and cultivated crops), would have helped further to hold the land in its place.

Rotation of crops would have prevented fields from becoming "worn out" by continual planting of one crop year after year. If lands had become worn out, they would have been planted in trees, soil enriching plants such as crotalaria, or turned into pasture.

These things could have been done, but they were not done. Because they have not been done widely in South Carolina, our crops are failing. Our commerce is dwindling, little by little. Our people are becoming ignorant and underfed. These facts may seem of little importance during a war, when high wages are being paid to everyone able to work, but after the war they will be of the greatest importance.

Our soil is going into the sea. Streams that were once wide, deep, and constant in their flow are now clogged, sluggish, stagnant runs, low in dry weather and flooded in wet. Floods gather quickly from eroded areas. The water table is going lower and lower. Ask the local "pump man"; he knows, and curses the fact.

To get our farmers to save their soil, we must show them the value, the common sense, the urgent necessity of saving it. If one man in a neighborhood engages in those conservation practices, the others soon see their value, and use them also. We cannot simply tell them, we must *show them*. We must show them that these common sense methods will bring them profit and happiness.

If we do not show them, we in South Carolina are doomed. There are no more places to move to. We are, literally, "stuck" where we are. With

little money in our banks, and with ignorant, underfed people forming a majority, we cannot survive as we are today. Farms that buy little and pay no taxes are liabilities instead of assets.

We must show our farmers. We *must* keep up with the rest of the world. We *must* excel.

We can.

WE SHALL!

DISTRICT WORK GROWS

During the first six months of 1944, according to R. W. Rogers, chief of the records and reports division, Soil Conservation Service, 26,925 farm and ranch conservation plans covering 7,867,234 acres were prepared in soil conservation districts. This planning rate represents an increase of 19.4 percent in number of plans and 8.1 percent in acres planned, over the same period last year.

As of June 30, 288,036 farm and ranch plans covering 62,118,997 acres of land had been prepared, and approximately 31,444,046 acres had been treated in the regular district program.

In recent months the organization of soil conservation districts has shown substantial increases:

New districts organized	
April 15 to May 15.....	48
May 15 to June 15.....	26
June 15 to July 15.....	26

As of July 15, a total of 1,140 soil conservation districts had been organized comprising 634,558,948 acres. In these districts there were approximately 2,462,000 operating units and 2,926,000 farms.

During the fiscal year ending June 30, 1944, 209 soil conservation districts comprising 78,745,790 acres were organized. During this same period 172 additions were made to 120 districts that had been previously organized. These additions totalled 23,863,634 acres.

Governing bodies of 1026 districts, totaling 583,309,059 acres, had signed basic memoranda of understanding with the Department of Agriculture and 1014 had signed memoranda of understanding with the Soil Conservation Service. At this same time there were 192 petitions for district organization pending.

By FRANK B. HARPER

A trip afield with Páll Sveinsson constitutes a fair travelog on the North Atlantic country of Iceland, whose shores he left for the first time in the summer of 1943 to come to the United States for several years' work and study of soil conservation.

You learn, for example, from this flaxen-haired, proudly Scandinavian Iclander that the land of the Eddas and Leif Ericson is not just a bleak and barren dot in the cold ocean, notwithstanding the fact that approximately one-tenth of its some 25,000,000-acre land area is ice capped. Nor is Iceland altogether a fishing country, though fish and fish products are the island's principal exports.

In short, Páll tells you in the surprisingly good English, which he taught himself after arriving in the states, that "Island," as it is spelled in his language, has a substantial agriculture in the year-round mild climate below the glacier line. Wool, hides, meat, cheese and butter are its prin-



Cat-tails were a form of vegetation new to Iceland's Sveinsson.

ICELAND'S son works on problem of shifting sands



Páll Sveinsson takes notes on beachgrass planting and other techniques by which the Soil Conservation Service has stabilized a 16-mile stretch of sand dunes along the Oregon coast below the Columbia River. With him is Robert L. Brown, manager of the Astoria nursery unit.

incipal agricultural exports. Ever since he finished at the northern Iceland agricultural school called Holar, this son of Svein has had his eye set on helping to make that agriculture better. When he turns homeward again, after two or three years' study of agronomy, forestry and other subjects, beginning this fall at the University of Minnesota, he will be better trained to resume the work he followed for three years in his country's soil conservation bureau.

A farm boy from south Iceland near Vik, 150 miles east of Reykjavik, the capital, Sveinsson is on a trip sponsored by his government but made partly at his own expense. His first year here has been with the Soil Conservation Service. During that time, he has studied erosion control and plantings in soil conservation districts and Ser-

vice nurseries and projects in Michigan, Texas, Oklahoma, Kansas, Nebraska, North Dakota, Montana, Washington and Oregon. It was in the last named Pacific Coast state that the visitor from Vesturskaftaflysysla, one of Iceland's 20 counties, found the mother lode of information bearing upon his country's soil erosion problems, sand stabilization.

Some 10,000,000 acres in Iceland are in grass and crops, Sveinsson estimates, divided in this manner: 8,000,000 acres of open range, and 2,000,000 acres in pasture and crop land, the crop land amounting to about 100,000 acres. The other 15,000,000 acres include mountains ranging from 2,500 feet to 7,000 feet elevation, lava flows, and sandy areas which alone total around 2,000,000 acres. Though Sveinsson is not a forester and Iceland has a separate forestry bureau working on farmstead plantings and the like, he will tell you that when his forbears went to Iceland a thousand years or so ago, much of the island was in timber, lava flows on this island of volcanic origin having destroyed some.

Earliest spoken records handed down, stumps found both in the valleys and the uplands, and

Drainage is another task facing Iceland's soil conservationists. With Regional Conservator J. H. Christ, young Sveinsson here inspects drainage work that farmers in the Sauvie Island Soil Conservation District near Portland, Ore., are doing to bring tule-infested lands into war crop production.

woodland remnants that have been protected all bear witness that there was timber mostly birch, willow and ash. There were no conifers. Generations back, however, Iceland became popularly known as "treeless," after almost all of the never large supply of timber had been cut off for fuel, building and other uses. Partly because of cool, virtually sunless summers, tree growth there is slow at best, Páll explains; but an early developed sheep industry destroyed the seedlings and, subsequently, other vegetation under overstocking. This, despite a rainfall of 100 inches or more a year in places, was followed by severe wind erosion in the sandy areas.

About 30 years ago, Gunnlaug Kristmundsson, who heads Iceland's soil conservation bureau, initiated a program aimed at the protection of the land. Today, under a soil conservation law, an agriculture department work unit in charge of a foreman may be found in nearly every county. Sveinsson is enthusiastic over the United States system of farmer-organized and farmer-administered soil conservation districts.

He explains, though, that a comparatively small amount of Iceland's agricultural land is in private ownership. This land lies chiefly in the 100,000 arable acres ranging from small potato farms to ranches of 300 acres or so. Some private owners, he adds, find it to their advantage to sell to the government and then continue to operate their



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places under the careful management plan that the government requires to be followed by farmers on its lands.

Comparatively limited, Páll explains, is the acreage of strictly government-owned land. Instead, the bulk of the range and pasture land is county-controlled. Unfenced and unpatrolled, this grazing land is operated as open range, presumably with herds of a given county using the range within that county, but with little restriction on stocking and use. The Iceland soil conservationist sees an opportunity for much range and pasture management development, both in the sandy areas and elsewhere, and is giving considerable attention to this phase of land use during his studies here. He also is interested in tree planting possibilities for erosion control in upland areas that have become too badly washed and gullied for grazing or other agricultural use.

Drainage of peat bog-type lands is another soil conservation problem faced in Iceland. Some machinery, mostly draglines, has been brought in and used in drainage work, though there is need for marked expansion in this direction. Though Icelanders operate several thousand automobiles, about half of them in the capital, Sveinsson points out that farmers depend upon horses of their own breed, just as their sheep are a special coarse-fleeced type and their cows likewise specially Icelandic, weighing around 800 pounds apiece. What tractors there are, are operated by groups.

The control of sand erosion in Iceland, as described by Sveinsson, commonly consists of building low walls of rock, or barriers of driftwood that the Gulf stream obligingly supplies free to

Sveinsson watches C. Dondo farming Sauvie Island land that a year ago was cat-tail swamp. It's on the Porter W. Yett place.

Icelanders. The control area is fenced against livestock and, when the barrier fences, some 250 feet apart, are covered by sand, European dune grass (*Elymus arenarius*) is planted. Some areas of once-drifting dune sand are now in pasture and hay.

On the north Oregon coast, where a 16-mile stretch of dune area has been stabilized so successfully under Soil Conservation Service direction that it has received international attention, the Iceland conservationist learned by actual practice how the sand-stilling European and American beach grasses are planted and followed by permanent, forage-type perennial grasses and legumes or by trees and shrubs. He also studied seed-collecting and other techniques at the Astoria Nursery Unit, which is in charge of this work that already has stopped completely the once alarming dune erosion threat to millions of dollars worth of agricultural land, military installations, municipal and other improvements.

Sveinsson's aim is to find out all he can about sand stabilization methods to improve his own country's control work, both in protecting the sandy lands themselves and in developing better forage. He also studied forage and other plant development and increase work at the Service's Pullman, Wash., nursery unit. Mild winters enjoyed at the lower elevations because of the Gulf stream's influence make it possible to use pastures

(Continued on page 86)

Iceland's brave soils face tough opposition



Water and wind eroded slopes in Thórsörk, southern Iceland.

By HAKON BJARNASON

Winds blowing over Iceland are damp as they approach the coasts. But on their way over the highland they become dry and carry the dust down to the lower regions, where much of it becomes embedded in the greensward and is thus added to the soil. All Icelandic soil has been built up in this manner since the end of the last glacial period, which, in the opinion of most geologists was about 8 to 10 thousand years ago.

The theory of Tutkowski concerning the conditions for the formation of loess soil will gain its strongest support in Iceland where the loess soil is still in the making, and the study of loess for-



Wind erosion after woodcutting.

mations can hardly anywhere be carried out under more favorable conditions.

The thickness of the Icelandic soil differs greatly, from a few centimeters up to 6 or 7 meters, according to its age and position. Even the marshes are loess formations to a certain extent, as up to 60 percent of their mass is made up of minerals carried through the air.

The comparatively young loess soil is very liable to leave by the same route it came, to be blown away as soon as its vegetation is damaged or injured to such an extent that wind and water can come in close contact with the soil. In fact, Iceland has suffered severely from soil-erosion and destruction of vegetation during the 1,000 years the country has been inhabited.

Loosely estimated, not more than 17 thousand square kilometers of the whole area of the country which is below 400 meters is covered with a contiguous vegetation.

Vegetation existing above this level of 400 is both so scanty and has such small utilitarian importance, that it can hardly be reckoned with. It is hard to stay for certain how big the area was which had a contiguous cover of vegetation before settlement. Some 43,500 square meters are less than 400 meters above sea level. Part of this area is in lakes and rivers, part of it is made up of sand deserts adjoining glaciers, continuously washed by rivers and glacial streams. The total area of such sand deserts is about 4,000 square kilometers, and rivers and lakes and new lava beds probably cover a similar portion of the land. Anyway, about 34,000 square kilometers below 400 meters must have been covered with vegetation at the time of the first settlers.

Above an altitude of 400 meters the extent of the vegetation has indubitably been much bigger than now, but as this vegetation has never been of much practical importance, it will not be further discussed here.

As already stated, about half of the area of vegetative growth which existed in the country

at the time of the first settlement has been totally laid waste. We know for certain that a great part of the land of vegetative growth was formerly covered with birch wood and birch-copse, and this vegetation has reached 400 meters above sea level or even more. Arborescent plants such as willows and heather have also been much more common than they are now but, on the other hand, all marshy vegetation was greatly inferior to what it is at present, the evidence of which can be seen in many of the marshes.

Besides the fact that the land bearing vegetation has been reduced by one-half, the quality of the present vegetation is much inferior to the quality of the ancient one.

There are three possible reasons for the colossal destruction of vegetation and the land bearing it: 1. Increasing severity of climate, 2. volcanic eruptions and their effects, 3. exploitation through excessive grazing.

We do not have complete evidence as to climatic conditions through 1,000 years, as pollen-investigations in marshes, which might throw light upon the subject, have not been conducted. We do, however, have written sources of information running as far back as the year 1200. These sources seem to indicate that hardly any radical change in climate has occurred. Accordingly, there is little



Post-glacial basalt on tuff and breccia, southern Iceland.

justification for blaming the destruction of soil and vegetation on altered weather conditions.

Volcanic eruptions have been very frequent from the first years of Icelandic settlement up to our time. The effects of these eruptions have usually been merely local, although the biggest ones have made themselves felt all over the country by the fall of ashes. Although a considerable area has been covered with lava-fields, this is not a very big percentage of the country as a whole. The ashes, however, are carried by the wind and are frequently injurious to vegetation; when striking places where soil erosion is in its first stage, ash-falls may have catastrophic consequences. It is a well known phenomenon, that great quantities of ashes can dry up marshes, making the latter liable to wind erosion. In spite of this, volcanic eruptions can not be considered a major factor in the destruction of soil and vegetation. If other destructive forces did not step in, the wounds thus inflicted would heal very soon. Proof of this can be seen where volcanic eruptions have taken place in uninhabited areas.

The third reason for destruction of soil and vegetation, and the most effective one, is the exploitation of the land by the people living on it.

Destruction of the woods removed the best defense of the soil, and conditions for the beginning of soil erosion on a large scale were at hand. When the protective forest had disappeared, wind and water had free access to every hole in the grassward and continuous grazing made its contribution to the disaster.

The best proof that it is the grazing which is mostly to blame for the erosion of Icelandic soil, rather than the weather or other uncontrollable forces and that it is the grazing, too, which maintains erosion more than anything else is to be found in the various wind eroded enclosures. Where the land is fenced and protected against



This telephone pole dates from 1922.



A typical loess soil brink in southern Iceland.

all grazing animals, it most often regains its cover, even though no seed is sown and only small tufts of growth have been left in the area. The most striking fact is, that high and big loess-brinks which were rapidly dwindling by this process, ceased being a defenseless prey of erosion with the return of vegetation to their sides.

Even if the general situation in livestock breeding has improved very considerably in recent years, the land is probably still suffering from excessive grazing. Now cattle graze only in the summer, and the grazing of horses and sheep avoided to every possible extent in winter except in fair weather. If the herds were evenly distributed over the pastures, about 5 horses, 25 cows and 39 sheep would be assigned to each square kilometer. In the more densely populated districts, however, especially in the southern and western part of the country, the number of livestock to each square kilometer is sometimes two or three times this number. Yields of herds are reduced and soil and vegetation are endangered.

I do not know how wide a vegetative area is needed to deal with the situation. This is a problem which has never been investigated here. But considering the difficult conditions all vegetation must meet because of cool and short summers, its resistance to excessive grazing must be much less than in many countries having more favorable climates.

Since 1899, there has been some cultivation of woods in Iceland. In the first years, this was of minor importance. In 1907 reclaiming of erosion tracts was started. At the same time the cultivation of forest was increased. Specially appointed government officials were charged with supervision of such matters. Last year the government spent 540,000 kronur on forestry and reclaiming of eroded areas. From an American point of view, this is not much, as it equals only \$80,000 in

American money. But in view of the fact that the population numbers only 125,000, this is a sizable though not adequate amount. This sum makes up 0.58 percent of the total public expenses. For the time being, six officials are charged with the supervision of the work.

Fencing has now been completed on 40,000 hectares of eroded tracts. These tracts are recovering, partly due to cultivation and partly on their own account. The areas thus protected are increasing every year. On the initiative of the State Forestry Service about 20,000 hectares have been fenced and protected, but only a fraction of this land is covered with birch-woods or copse. The birch-wood spreads very rapidly in many of the enclosed areas, and all the fenced tracts show steady growth.

One of the greatest problems in Icelandic forestry is to grow conifers. Due to the isolation of the country, no native coniferous trees are to be found, except *Juniperus communis*, var. *nana* Willd, but in recent years a considerable amount of tree-seed has been imported from Alaska with the cooperation of officials of the U. S. Forest Service in Juneau, Cordova and Seward. The climate around Prince William Sound and Cook Inlet is very similar to that of Iceland, and Sitka-spruce from those areas find excellent conditions in Iceland. At the same time, and this is another major problem, the cultivation of Icelandic birch must be given consideration, not so much for the sake of the wood itself, but because it is the country's best defense against soil-erosion.

Progress in the last 40 years in the reclamation of deserted ground has been very good, so good that those who were most optimistic have not been disappointed, and it has fully justified the expenditure of more and more money through the years.

ICELAND'S SON

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in Iceland all winter. This situation aggravates overuse, particularly by the sheep, which run in flocks of 100 to 1,000. Dairy stock is on pasture only from April through October. Fish meal, as a by-product of the fishing industry, is coming into wide use for stock feeding.

You get the impression from Páll that the people of this world's youngest democracy are pretty self-sufficient. Though their only fruit consists of wild fruits and berries, potatoes are a main cultivated crop; root crops, cabbage and such, do well. Tomatoes are grown in hothouses supplied by the island's famed thermal springs that are displacing imported coal for general city and farm heating

purposes. Spinning, tanning and other processing still is done largely on the farms.

Iceland is without railroads, but has highways around the south, west and north sides. In addition to the north Iceland agricultural school which Páll attended, and the university at the capital, there is another agricultural school, in southern Iceland. It is called Hvanneyri and is headed by his brother, Runolfur, who also planned a 1944 visit to the United States, to study livestock breeding, farm machinery and other subjects.

A highlight of Páll's visit, while in Portland working with Regional Conservator J. H. Christ and staff under direction of Dr. A. L. Hafenrichter, chief of the nursery division, was watching circus elephants perform at a Victory Center program just outside the regional office windows. The visitor never had seen an elephant in his homeland, where pachyderms decidedly are not native. Even a national-capacity audience in that country of between 125,000 and 130,000 population hardly would tempt a showman to ship such ponderous beasts to the northland island.

REVIEWS

WOODLAND OPPORTUNITIES ON DAIRY FARMS IN NEW YORK. By Hugh A. Johnson, Irving C. Fellows, and Donald Rush, Bureau of Agricultural Economics, and C. R. Lockard and C. Edward Behre, Forest Service, U. S. Department of Agriculture. Washington, D. C. 1944.

This bulletin is a report of a study of how farm woodland management could integrate with other farm activities in New York to enable farmers to make a better living. It should be helpful to all agriculturists and foresters interested in guiding the way to a more stabilized agricultural industry and the betterment of rural communities. It is of particular interest to the Soil Conservation Service because it is with such problems that its farm planning organization is struggling all the time.

A study was made on 90 farms ranging from 60 to 662 acres, all members of the Otsego Forest Products Co-operative Association. The agriculture of the county is predominantly dairying, producing wholesale milk for New York City. The report goes into the economic details of the various farm enterprises, first classifying the 90 farms by income received based upon size of herds. Next, the farms are classified according to size of merchantable woodland, comparing income from the woodland enterprise with that from other farm enterprises. An average net income of \$118 per farm is shown from the woodland, and \$1,195 from other enterprises. Also revealed is the fact that the woodland expenses were low, consuming only one-third of the gross income, while the expenses of other enterprises consumed 60 percent of the cash income.

The next phase of the report deals with the adjustments which should be made in farm management to increase income. The importance of integrating farm forestry with the farm business is emphasized. The methods of so doing are explained, and the resulting advantages to the farmer are indicated. To illustrate the place of woodlands in the farm organization and the effects of proposed adjustments

on net farm incomes, two typical farms were studied, and detailed summaries of present and potential economic factors and incomes are presented. In addition, a study of a third farm was made to illustrate the comparative returns from good and poor farm woodland management practices. These three studies add much to the practical value of the bulletin.

It is interesting to learn what returns can be expected from a northern hardwood woodland of 56 acres when the growing stock is fully developed. The estimated annual cut is 19,000 board feet and 48 standard cords, or 340 board feet plus .86 cords per acre. Logs of high quality should be worth \$25 per thousand, and 35 of the above cords should sell at \$6 per cord along side the road ready to haul. The total return, labor and stumpage, is estimated to be \$685 or \$12.20 per acre per year.

A few quotations will help to give an idea of the scope of the bulletin: "As a prerequisite to good forest management the farmer must plan his operations and adopt practices to develop and maintain a productive growing stock from which crops of wood may be taken as a regular part of the farm business" (page 9). "Careful study of the farming operations, however, will usually bring to light inefficiencies in building arrangements, barn layout, field arrangement, job sequences, or other practices. Stopping these leaks will maintain output with less labor" (page 13). "With the exception of the few operators who are too old or disabled, there is little question that farmers could substantially increase their woodland earnings by greater use of available time, labor and equipment" (page 13). "Furthermore, as wood will grow without close attention and can be stored on the stump, there is less time urgency in the management of the farm woodland than in the management of the other enterprises. Once farmers realize that a forest enterprise can be a profitable supplement to a dairying, more operators will divert labor to the farm woodlands" (page 14). "Authoritative information on relative earnings in forestry as compared to other farm enterprises is needed. Such evidence as is available indicate that labor income per hour in woods work compares favorably with other farm activities" (page 15). At the end is an appendix containing supplementary and explanatory material, helpful in understanding some of the principles used in making the study.

—JOHN F. PRESTON

WATER SPREADING

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that the spreader cost may equal the value of the land involved. In dry years the performance of spreaders sometimes fully justifies an outlay in excess of the value of the land. Earth-fill structures are usually cheaper than masonry or other types of structures, and for this reason have been most commonly used.

It must be kept in mind that there will be some maintenance required. After a spreader has operated a few times there are, too, usually some refinements and supplemental structures that suggest themselves. Allowance should be made for this additional investment expense in figuring the prospective costs.

The design of water spreading structures challenges the ingenuity of the planning technician and is a good example of the old adage that two heads are better than one. The technician and the rancher working together can produce a much better layout than either could do alone. The best water spreaders aren't built to a pattern. They are built to fit the ground.

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OFFICE OF INFORMATION U. S. DEPARTMENT OF AGRICULTURE

Comparison of Native Grasses and Crested Wheatgrass and of Supplements for Beef Cattle in the Northern

FARM FORESTRY TO RESCUE

(Continued from page 78)

million feet the redwood in Eureka Canyon. There is more farther west. Tindall also has brought a million feet of stumpage on the Arnold Baldwin property a couple of miles from his own farm. He plans to apply woodland conservation methods in cutting from this 640 acres of second growth redwood and tanbark oak.

"We can cut for years and years," he says. "They (the redwoods) come on fast. We could remove a million feet a year."

Tindall calls attention to the fact that one 58-year-old redwood yielded 1,500 feet of lumber. Tindall has some madrone, expects to find a market eventually for furniture.

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